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THESIS

IMPROVING ORGANIZATION PRODUCTIVITY
WITH
INFORMATION TECHNOLOGY

by

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September, 1995

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Downsizing, reinventing government and technological change are the external forces which have created the turbulent environment for public and private organizations. Information technology provides tools which allow organizations to react constructively to this turbulence. However, there is evidence that despite investments in new information technologies, productivity and profitability within the United States has fallen. A conventional explanation is that technological change is moving faster than humans are able to change in order to exploit the advances in technology. Those uncomfortable with new technologies feel threatened and do not use them to their full potential. If the information technology is not integrated into the organization's strategy, structure, and management processes, management will not be able to capitalize on its technology investment. This thesis presents a thorough literature review and case study research of a Department of the Navy organization, to answer the question: How can organization managers ensure their investment in information technology will increase organizational effectiveness, measured in terms of increased productivity?

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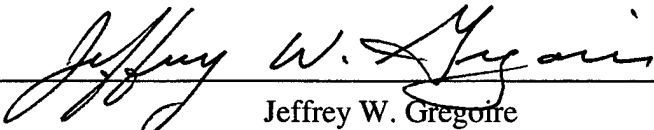of the requirements for the degree of

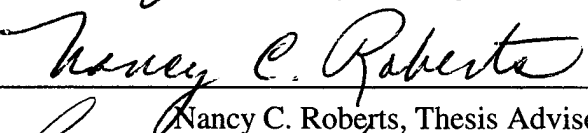## MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT
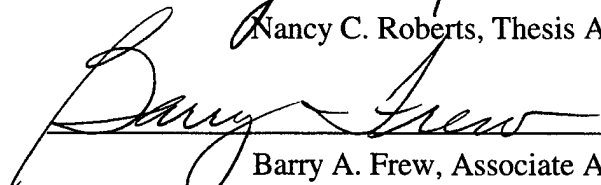
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ABSTRACT

Downsizing, reinventing government and technological change are the external forces which have created the turbulent environment for public and private organizations. Information technology provides tools which allow organizations to react constructively to this turbulence. However, there is evidence that despite investments in new information technologies, productivity and profitability within, the United States has fallen. A conventional explanation is that technological change is moving faster than humans are able to change in order to exploit the advances in technology. Those uncomfortable with new technologies feel threatened and do not use them to their full potential. If the information technology is not integrated into the organization's strategy, structure, and management processes, management will not be able to capitalize on its technology investment. This thesis presents a thorough literature review and case study research of a Department of the Navy organization, to answer the question: How can organization managers ensure their investment in information technology will increase organizational effectiveness, measured in terms of increased productivity?

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I. INTRODUCTION

A. RESEARCH QUESTION

Downsizing, reinventing government, and technological change are the external forces which have created the turbulent environment for public and private organizations. Information technology provides tools which allow organizations to react constructively to this turbulence. However, there is evidence that despite investments in new information technologies, productivity within the United States has fallen. This thesis will address the question: How can organization managers ensure that their investment in information technology will result in increased effectiveness, measured in terms of improved productivity?

B. RESEARCH METHODOLOGY

Qualitative research methods were used in the development of this thesis. A literature review was conducted providing an academic answer to the research question. Next, a cross-sectional view of a Department of the Navy organization provides a case study of how a particular organization implemented information technology.

The organization chosen for the case study is the Naval Aviation Systems Team. The information technology system is the Naval Air Systems Command's, Information Systems and Technology Division, information technology wide area network, referred to as the NAVWAN. The Naval Air Systems Command was recently commended in a November, 1994 Government Computer News article for their innovative use of information technology as an enabler of the command's business process reengineering project.

The NAVWAN provides an infrastructure to support a common, multi-purpose, standards based information network across the entire Naval Aviation Systems Command and other major Naval Aviation installations. Prior to this new technology, there existed a myriad of stovepipe/proprietary networking systems which could not interoperate. The NAVWAN provides an open systems architecture and standards-based framework which

provides desktop computer communication functionality throughout the network (NAVAIRINST 5230).

This thesis will evaluate the implementation of information technology within the Naval Aviation Systems Command organization and show who was responsible for the implementation of the technology, what methodology was used, where the major resistance to the technology occurred, and how the technology impacted the organization.

1. Literature Review

A literature review was conducted examining books, journals and periodicals. An interpretive discussion of how the literature applies to the research question is provided in Chapter II.

2. Archival Research

Information sources internal to The Naval Aviation Systems Command were researched for the purpose of obtaining background on the organization and the NAVWAN implementation. Documents such as official instructions, memoranda, discussion papers and briefing overviews were made available for review. The Naval Aviation Systems Command NAVWAN file transfer server provided a significant amount of data covering NAVWAN program management and implementation. The majority of Chapter III is the result of this archival research.

3. Interviews

Ten personal interviews were conducted with members of the Naval Aviation Systems Team, six from the Information Technology Management Functional Area and four from program management offices. The individuals were selected based on their scheduled visits to the Naval Post Graduate School. The positions of those interviewed varied from NAVWAN program manager to Integrated Program Team (IPT) leader.

The selection of interview participants was based on obtaining a cross section of information technology specialists and program management process experts. The NAVWAN program managers provided a information technologist's perspective on the technology implementation process and the IPT leaders gave insight into the use of the technology by business process experts. Telephone interviews were conducted as a follow

on to the personal interviews, as well as electronic mail correspondence. The case analysis provided in Chapter IV was based on the interview results combined with literature reviews and archival research.

C.   RESEARCH CONSTRAINTS

The primary research constraint was the lack of funding. Financial resources were not available for travel to conduct on-site interviews or observation. This would have been optimal for this case study research. However, individuals interviewed did provide sufficient data to complete the research.

D.   SUMMARY

This thesis provides an answer to the difficult question: How can organization management increase productivity through the implementation of information technology? The answer provided is based on extensive literature research and a cross-sectional view of an organization based on archival data and personal interviews. The answer provides a framework for organization managers to effectively use information technology in a complex and dynamic environment where doing more with less is paramount.

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II. LITERATURE REVIEW

A. INTRODUCTION

How can organization managers ensure that their investment in information technology will result in increased effectiveness, measured in terms of increased productivity? Morton (1991), Zuboff (1988) and Drucker (1988) all identify the problem as one of management, not technology. A conventional explanation is that technological change is moving faster than humans are able to change in order to exploit the advances in technology. Those uncomfortable with new technologies feel threatened because they do not understand information technology's full potential, or the characteristics of an organization that are required to exploit the full potential of information technology.

This chapter will answer the question in three parts. Section B provides an explanation of the potential capability of information technology that organizations should strive to exploit. Section C discusses the characteristics of an organization that enables it to exploit this capability. Section D explores the requirement for an organization change strategy that attempts to exploit the potential of information technology.

B. CAPITALIZING ON THE POTENTIAL OF INFORMATION TECHNOLOGY

The proliferation of advanced information technology demands that the typical organization be information-based, composed of knowledgeable specialists who direct their business actions through coordinated feedback with superiors, peers, and customers. To accomplish this requires a clear understanding of the organization's information requirements acquired through intense analysis and diagnosis of business processes. Without this understanding, there is a risk of using the technology only to accomplish existing processes faster (Drucker, 1988).

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Zuboff (1988), addresses a fundamental duality of information technology:

> On the one hand, the technology can be applied to automating operations according to a logic that hardly differs from that of the nineteenth-century machine system - replace the human body with a technology that enables the same processes to be performed with more continuity and control. On the other, the same technology simultaneously generates information about the underlying productive and administrative processes through which an organization accomplishes its work. It provides a deeper level of transparency to activities that had been either partially or completely opaque. In this way information technology supersedes the traditional logic of automation (Zuboff, 1988).

Zuboff coined the term informate to describe the capacity of information technology to provide an insight into the processes an organization uses to conduct work. If organizations desire to attain the maximum benefit from information technology, they must be driven to use the informating capacity of the technology. However, technology alone, no matter how well designed or implemented can be relied upon to carry the burden of creating an informating strategy. Managers must be aware of the choices they face, have a desire to exploit new information technology, and be committed to change hierarchial relationships within the organization. Without a commitment to change, the hierarchy will use technology to recreate itself (Zuboff, 1988).

The real power of technology is its ability to informate, to create new ways of accomplishing work and not merely automating old processes. Instead of asking: How can we do what we do faster, better and at a lower cost? Managers must ask: Why do we do what we do at all? A goal of automation will result in more efficient execution of existing processes, but will reinforce old ways of thinking and old behavior patters. This thesis assumes that the goal is increased productivity through information technology's ability to create new, more productive business processes. The employment of information technology with this as the goal is a challenge for managers and key to survival in today's dynamic environment (Hammer and Champy, 1993).

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C.   ORGANIZATION CHARACTERISTICS REQUIRED TO INFORMATE

Figure 1 illustrates three human resource forces within an organization which must be aligned with information technology, if the organization goal is to informate. The three boxes in the center, structure, management processes, and individuals, roles & skills, are described as the "people issues", the forces which contribute to a culture which is able to transform itself into an informated, knowledge-based organization. In an effort to understand how organizations can maximize productivity with information technology, each of the three organizational forces will now be examined in detail. Emphasis is placed on their relationship with information technology.
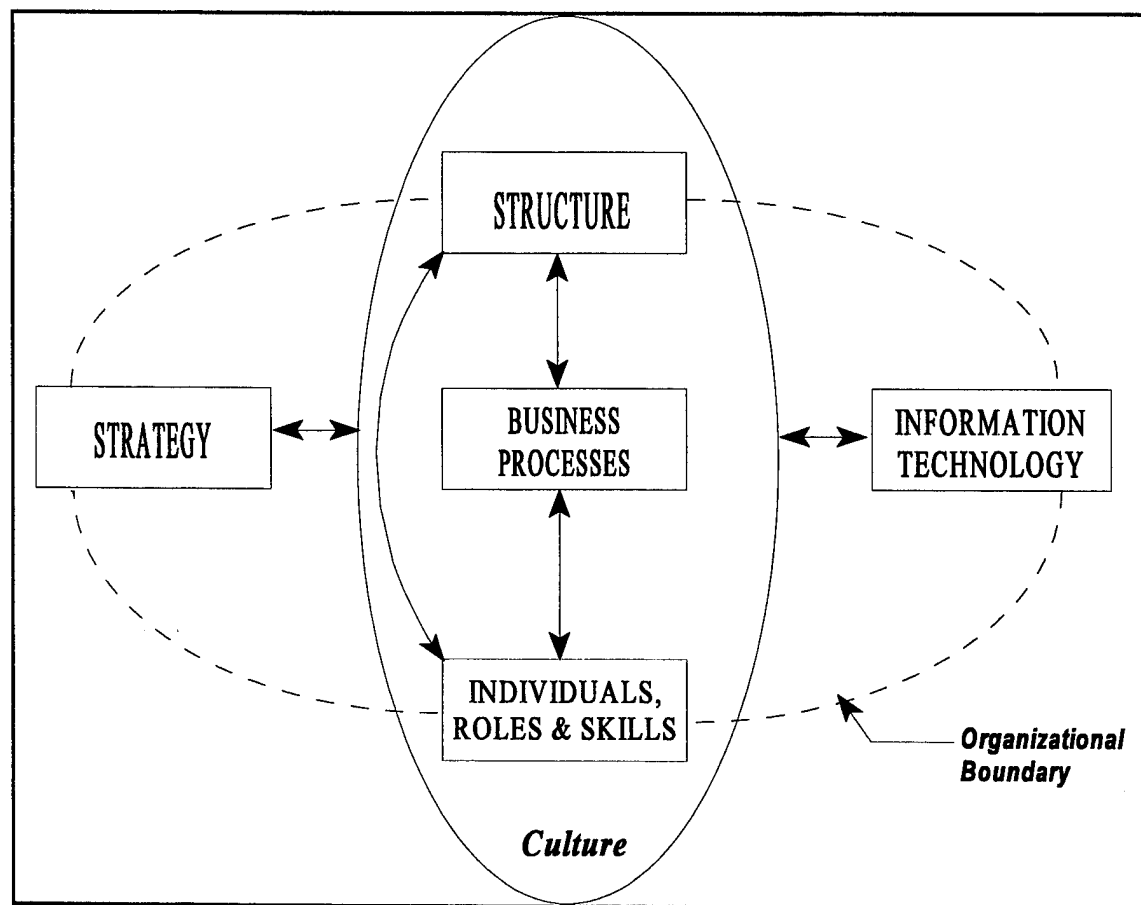

Figure 1 Aligning Information Technology and Organizations from Morton (1991)

1. Structure

a. Definition

Mintzberg (1983) proposes structure to be a collection of the ways an organization directs and coordinates its work into tasks performed by people with specific skills.

b. Current Structure

Military organizations are typified as hierarchically structured machine bureaucracies. This type of organization consists of multiple layers of management which exists, not to make decisions or lead people, but to pass data down the hierarchy when deemed appropriate. This data is primarily used for control, not in providing information (Bushe and Shani, 1993). Organizations with this structure operate with few liaison devices and depend on coordination from a centralized strategic apex, where the real power lies (Mintzberg, 1983).

c. Required Structure

In order to exploit the informating potential of information technology, Drucker (1988) envisions the emergence of flatter organizational structures which resemble that of an assembly of players in a symphony orchestra. Each player is responsible for their part of the entire score and only receives minimum guidance from the conductor. Each player is a member of a team of specialists working in a structure based on collaboration and communication.

Organizational structure that optimizes the integration of information technology must be considered if the goal is to exploit the informating nature of the technology. The emergence of team-based, process-focused groups, supported by computer networks is given as an organizational structure for the 1990s (Morton, 1991). Organizations such as AT&T, Eastman Kodak, Xerox, and Pepsi-Cola are developing team-oriented, horizontal structures. The objective of these companies is to eliminate the corporate mind set of climbing the hierarchial ladder to the top. By eliminating corporate boundaries

between functional areas, one can increase information sharing and organizational responsiveness to change (Byrne, 1993).

The concept of information, being relevant and purposeful data, implies a required level of knowledge in order to transform the data to information (Drucker, 1988). In an informated organization, this knowledge will reside with self-managing teams, where cross-functional coordination is more critical than managing up and down a top-heavy hierarchy (Byrne, 1993).

Information technology, implemented within an appropriate organizational structure, will provide the framework for establishing information-driven work processes. Traditional hierarchy does not facilitate the collaborative and communicative requirements of an informated organization. The use of information technology in support of task-focused teams is a critical step towards informating (Drucker, 1988).

The transition from a hierarchial to a team-based structure requires a management paradigm shift. Hierarchy characterizes personal interactions based on positional authority where team management focuses on personal interactions based on an individuals ability to learn and to promote learning in others. In the informating structure, emphasis must be placed on team collaboration and communication (Zuboff, 1988).

A building block of a team-focused, informating structure, is a commitment to the concept of information responsibility. Every team member must engage themselves in the process of evaluating the information they hold in terms of who else in the organization can benefit from this information, and what information do they need to supplement what they have. Information technology enables real time information sharing, but without a sense of responsibility by all members, the structure will not informate (Drucker, 1988).

Senge (1990) describes the phenomenon of alignment as the group synergy that takes place when a group of people function as a whole. This synergy is required in

order for the team to achieve performance levels greater than the combined performance of its members. Without alignment, team performance will suffer and managing the team will be difficult.

Katzenbach and Smith offer the following essential discipline that successful teams share:

> A team is a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable (Katzenbach and Smith, 1993).

Teams differ from work groups. Work groups are effective when the goal is improving individual performance. They provide an opportunity for individuals to meet and share insight and perspectives. Successful work groups improve individual performance of its members through group discussions, debate and information sharing. Teams not only benefit from this, but more importantly, combine work of two or more people to enhance performance levels beyond what is attainable by the sum of its members (Katzenbach and Smith, 1993).

Katzenbach and Smith (1993) provide the following attributes of a team:

- Shared leadership roles

- Individual and mutual accountability

- Specific team purpose that the team itself delivers

- Collective work products

- Encourages open-ended discussion and active problem solving

- Measures performance directly by assessing collective work products

- Discusses, decides, and does real work together

Current information technology communication capabilities allow organizations to design networks which can optimize team performance. Information technology is the platform upon which data is made available and connects team members while minimizing time and geographic constraints. Electronic tools provide a means of collaborating team work in a way that can totally change the dynamics of the organization and supports a goal of informating (Rockart and Short, 1991).

2. Business Processes

a. Definition

Business processes are defined as a collection of activities that takes one or more inputs and creates outputs (Hammer and Champy, 1993).

b. Improving Processes with Information Technology

To effectively integrate this organizational team structure and information technology, the individuals involved in organizational restructuring must understand the implications of information technology. That is, the organization must understand the disruptive and process redesign enabling capabilities of information technology. This will develop an environment of technology users specifying the structural changes needed to enhance business processes based on what they understand is now possible due to information technology (Bancroft, 1992).

Many organizations have invested in information technology to automate portions of their business processes. With automation as the goal, the results have been scattered computer networks and incompatible computer platforms through out their organizations. To exploit the informating nature of information technology, the organization must develop an enterprise model which uses information technology to describe its business processes. The model should include a method for determining how the organization can change to create an information based team structure (Haeckel and Nolan, 1993).

(1) Process Modeling. Managers of an informated organization should collaborate with information technology experts to develop a technical model of business

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processes. This technical blueprint will allow development of expert systems, databases, and other technical tools to assist organization management. As business processes change, the model must change. There must also be latitude within the model to allow for unplanned contingencies and decision making. The success of information technology depends on management's ability to coordinate and share business objectives throughout the organization. The manager of an informated organization recognizes the importance of integration between business functions focusing on connectivity, sharing, and structuring information. A coherent business process model provides managers a means of establishing who is accountable for information and how it is being interpreted. This allows them to establish policies that result in efficient use of information and improved processes (Haeckel and Nolan, 1993).

Bancroft (1992) describes the technical blueprint as the information technology infrastructure framed by business needs. The blueprint should express the following:

- Corporate impact - How can information technology contribute to the success of the business? How can it affect employees?

- Data management - What data can be gathered, stored, and managed? Who should have access to it and how? How will it be designed and structured?

- Communications - How are business units connected? How will the connections be controlled?

- Application development - Who should develop applications and what standards/quality assurance will they adhere to?

- Technology - What types of hardware and software should be used and for what purpose? How will it be acquired?

- Models - What models of integration can be used across functions and geographic boundaries?

- Quality assurance - What standards will be used?

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- <u>Implications</u> - What will be the impact of the new technology on, training and organizational support?

- <u>Organization</u> - How should the information systems function be organized, measured, and rewarded?

Within the Department of Defense the modeling methodology identified by the Director of Defense Information to be used for modeling business processes is the Integrated Computer Aided Manufacturing Definitions Language or IDEF. IDEF was created by the Air Force in the 1970s to increase productivity by identifying procedures for developing business process models and associated data structures used to build the models. IDEF defines the organization's business processes and relationships down to the lowest level in the organization. It accomplishes this by identifying all critical success factors influencing or flowing from a process and categorizes them as either inputs, outputs, controls, or mechanisms (White, 1992). The model produced defines the current way processes are accomplished, but the power of information technology is that it enables redesigning business processes or reengineering.

(2) Process Reengineering. Hammer and Champy (1993) define business process reengineering as:

> The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed.

This definition includes four key words (Hammer and Champy, 1993):

- <u>Fundamental</u> - The fundamental questions in business process redesign is: Why do we do what we do? And, why do we do it the way we do? These questions force people to look at the underlying rules and assumptions of their processes. This questioning can uncover inappropriate rules which control obsolete processes.

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- Radical - Hammer and Champy use radical in their definition to emphasize that redesign should disregard existing structure and procedures and invent completely new ways of accomplishing work.

- Dramatic - The goal of a reengineering effort is not to make marginal improvements but to achieve quantum leaps in performance.

- Process - Hammer states that most business managers are not "process oriented" but are focused on the individual process elements such as tasks, jobs and hierarchial relationships.

Information technology, when used correctly, can enable successful process redesign. The power of information technology is that it opens doors to opportunities people never imagined possible. The challenge is for organizations to understand this power and resist using the technology to automate existing processes. An informated organization understands and exploits what Hammer (1993) describes as "the disruptive power of technology". This is the power information technology has to break the rules which govern our current processes and allows the creation of new processes (Hammer and Champy, 1993).

The real power of information technology is that it provides a mechanism to allow organizations to recreate its structure and make its business processes better than before. It allows the organization to break old rules and to uncover problems they probably never knew existed prior to the capability provided by information technology (Hammer and Champy, 1992).

c. Business Process Management

The commitment to informate is a commitment to learn how to do business processes better, through an understanding of the organization's information. The informated organization relies on knowledgeable, empowered workers with access to information. This implies a shift of control from managers to teams of workers (Benjamin and Blunt, 1992).

Drucker (1988) describes the management paradigm associated with an information-based organization with this symphony orchestra analogy:

> Because the "players" in an information based organization are specialists, they cannot be told how to do their work. There are probably few orchestra conductors who could coax even one note out of a French Horn, let alone show the horn player how to do it. But the conductor can focus the horn player's skill and knowledge on the musicians' joint performance. And this focus is what leaders of an information based organization must be able to achieve.

Management based on imperative control exists in a hierarchial organization. This management style is inadequate to develop the informating capacity of information technology. New technology redefines what is possible and information specialists have the knowledge to implement the technology. Managers must decide what technology needs to be implemented. The role of management is to set the course for informating. There must be a vision communicated throughout the organization guiding an informating strategy and there must be policies that support and encourage people to learn and evolve with the new technologies (Zuboff, 1988).

The role of management should focus on providing overarching guidance and encourage local initiative. The guidance should be expressed in terms of a vision clarifying the direction the organization should move towards. Without this guidance there will not be a collaborative improvement in organization processes. Instead, there will be isolated attempts of improvement that don't add up in a meaningful way (Kotter, 1995).

Local initiative is achieved by developing rewards, recognition, and career opportunities for members who embrace the principles of learning embedded in an informated organization. As organizations focus on team learning, the organization leadership must establish policies which promote ownership and commitment to the change. Employees must be encouraged to participate in the process of interpreting value from data and constantly evaluating business processes for improvements. Management must provide

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employees a scope for creativity and through interaction with information technology the result will be improved productivity (Drucker, 1988).

d. Focus on Institutional Learning

Implementing information technology with a goal of informating requires a management effort that integrates business processes with technical capabilities. This requires a shared vision of an integrated environment which blends business, technical and organizational elements that work together. The first step towards informating is a high-level driver supporting this integrated vision. Whether the support comes from a single person or a group of people, there must be a commitment to communicate the vision, publicly demonstrate support of the vision, and work to overcome resistance to the vision (Bancroft, 1992).

The vision communicated throughout the organization should emphasize the need for institutional learning. Institutional learning is the continuous process of observing and sensing signals from the environment, interpreting those signals, selecting the appropriate response and finally executing the selected course of action. An informated organization is one which uses information technology to determine what is happening in the environment and to model how the organization currently operates. The strategic informating vision fills in what the appropriate response to the sense and interpret process should be (Haeckel and Nolan, 1992).

Figure 2 illustrates this learning process. It was originally developed by the United States Air Force as a training tool for fighter pilots. It provides a framework that guides managers to achieve organizational learning. The model illustrates the process of extracting value from environmental data that is interpreted as purposeful information. This information is applied to current business processes and evaluated in terms of what action, if any, is required based on the new information. Integrating information technology to interpret data from the operating environment and comparing this information to how the organization currently operates is a characteristic of an intelligent, informated organization (Haeckel and Nolan, 1992).

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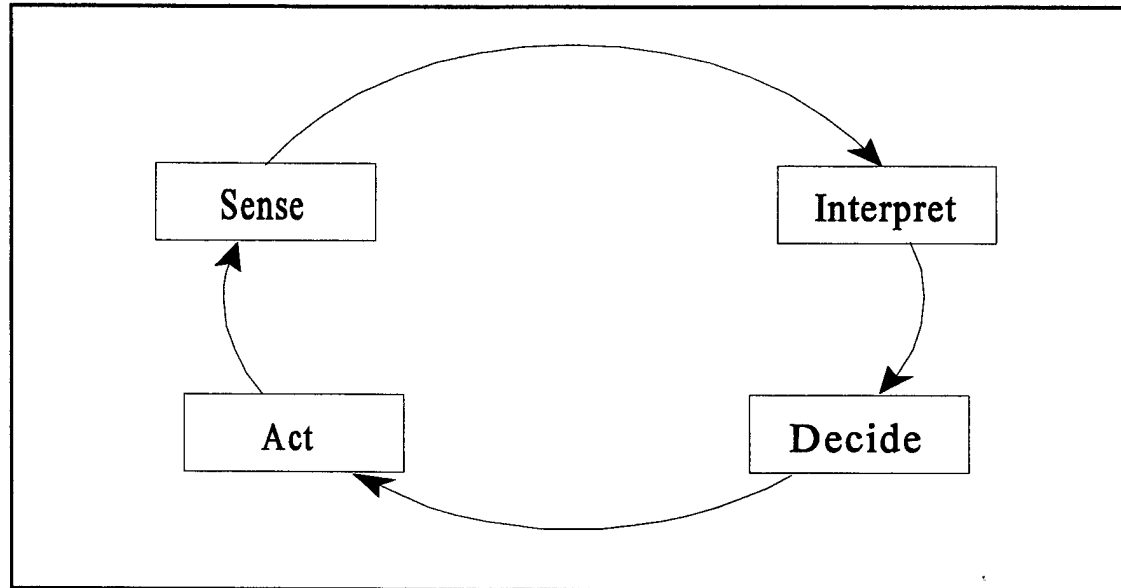
Figure 2 Organization Learning Loop

The goal of creating an intelligent, informated organization hinges on its ability to learn. By integrating information technology with business processes a distribution of knowledge will occur throughout a wide range of organizational members. Management is needed to guide and coordinate the learning efforts of the organization to ensure that the correct strategic, value added alternatives are being selected (Zuboff, 1988).

3. Individuals, Roles & Skills

Zuboff (1988) argues that information technology will distance workers from traditional roles and will require, instead, that they learn the meaning of the data generated by computer-driven processes and discover how to fit these data together into a coherent understanding of the process. The fact that information technology will reshape work can not be disputed. The break down of functional barriers, creation of empowered teams and the integrative nature of information technology typify an informated organization. These factors result in changes to traditional roles of supervisors and managers. Managers must be willing to share their knowledge as opposed to using the knowledge as power. As members

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of teams, workers will need to develop not only technical skills but those involving negotiation, persuading and conflict resolution.

The integrative nature of information technology will require that technical specialist interact with managers and organizational specialists. There exists distinct mind sets between the technology and business specialists. Technology specialists typically react to change rather than lead it. Business managers will concentrate on structure and leave the process improvement and work redesign to others. Organizational specialists will concentrate on work processes then create a structure without considering technology. The informated organization requires a blend of these three mind sets. There must be a consolidation between functional areas with everyone willing to learn new ways of working and thinking (Bancroft, 1992).

In an informated organization, each employee must constantly think through what information is needed to do their jobs. As a collection of knowledge specialists, an informated organization will emphasize collaboration and communication. The concept of information responsibility provided by Drucker (1988) must be instilled in each member of the organization. Members of the organization must act as participants in team problem solving and decision making. This requires individuals to develop new competencies such as analytical and interpersonal skills supported by knowledge of the organization as a whole. The effective integration of information technology hinges on the organization members ability to learn and adapt. Simply issuing an organization vision of teamwork will only create a different look to the organization chart unless members are committed to the change and are provided training in the competency areas required for team focused processes (Beer, Eisenstat and Spector, 1990).

D.   ORGANIZATIONAL CHANGE

For information technology to be used to its full potential, organization management must be capable of addressing people, structure, and process issues in an integrated fashion. Implementation of information technology is a task of managing change, moving from a

bureaucratic hierarchy to a horizontal team-focused structure, empowered knowledge specialist, and cross-functional area business processes.. The transformation to an informated organization is a challenge for management and can be the weak link in effective implementation of information technology (McKersie & Walton. 1991).

Kotter (1995) provides eight steps to transforming your organization:

1. Establish a Sense of Urgency

2. Form a Powerful Guiding Coalition

3. Create a Vision

4. Communicate the Vision

5. Empower Others to Act on the Vision

6. Plan and Create Short Term Wins

7. Consolidate Improvements and Produce More Change

8. Institutionalize New Approaches

Kotter (1995) believes that a sense of urgency is required to motivate people to change. The transition to an informated organization requires cooperation and support from everyone in the organization. To solicit this support there must be sound organizational leadership. Too often, a lack of urgency to change comes from a "paralyzed senior management", which is a result of having too many managers and not enough leaders. Managers tend to focus on minimizing risk to the current system. Leadership is required to guide and solicit support for the creation of a new system. The urgency may come from dissatisfaction with the way things are or from a desire to capitalize on new opportunities. Organization management must be convinced that business processes need to be improved and recognize information technology as a critical enabler of this improvement.

The sense of urgency to change may start with a few individuals or a group, but once it exists it must be acted on. A coalition must be established to guide the change effort. The coalition should consist of information technology and business process specialists from a cross-section of organization levels. However, to ensure that the coalition is powerful, senior management representation is required. The organizational power that comes from senior management status, expertise and reputation should be combined with key stakeholders from functional line management positions who deal with current processes directly. This combination may be awkward, especially in a military organization where individuals with varied rank are grouped together in the coalition. However, the task of redefining how the organization should recreate its operating processes requires the group to work outside of its normal boundaries and established protocol (Kotter, 1995).

A significant challenge for the coalition is the integration of the varied mind sets between business managers and information technology specialists. Historically, information technology specialists have required specific technical skills that developed into a pure technology-driven perspective. Too often, information technology specialists have an embedded "ones and zeros" mind set. This perspective is too narrow for a successful transition. Information technology specialists must integrate with business managers and provide the technology tools required to enable change. The business manager typically is not concerned with the details of the technology but only on process improvement. Integration of the two mind sets will enhance the coalition's ability to develop a vision of where the organization needs to go and use technology to get there, as opposed to technology driving the process (Bancroft, 1992).

The coalition must develop a picture of the future of the organization, describing the direction the organization needs to take to get there. This vision must be developed using a coherent vision framework. At the core of the framework is a guiding philosophy which encompasses the organization's core values and purpose. An example is the guiding philosophy of 3M, originated by its CEO in 1931, William McKnight: About People, "I think every employer has a real moral responsibility, to see that employees are able to secure life's

necessities during the time of distress." About Products, "The 11th commandment: Thou shalt not kill a new product idea." "Many great product ideas come from stumbling, but you can only stumble if you're moving." These core values should become ubiquitous throughout the organization and perceived as sacred, not to be violated under any circumstance. The other component of a guiding philosophy is the purpose of the organization, or why the organization exists. An example of a purpose statement is that of Apple Computer: "To make a contribution to the world by making tools for the mind that advance humankind." Not all organizations write down its core values and purpose, but doing so will be beneficial to the development of a effective vision statement (Collins & Porras, 1991).

The next component of a vision should be explicit articulation of the organization's transformation goal. It should be easily communicated and understandable. The only way to successfully transition the organization is through maximum individual commitment, often requiring individual sacrifice. The best method is by maximum vision communication through every possible means and more importantly, an outward commitment to the vision by the guiding coalition and senior management through actions that are consistent with the vision statement (Kotter, 1995).

The major challenge of the change effort is to remove obstacles to the new vision. A critical step in dealing with resistance from organization members is to ensure they understand and transition through change. If an individual understands their own and others response to change they will be better prepared to transition into new roles and responsibilities within the organization. Figure 3 illustrates the emotional phases each of us moves through as change occurs. It is based on Tannenbaum's (1985) comparison of an individual's reaction to change and the grieving process.
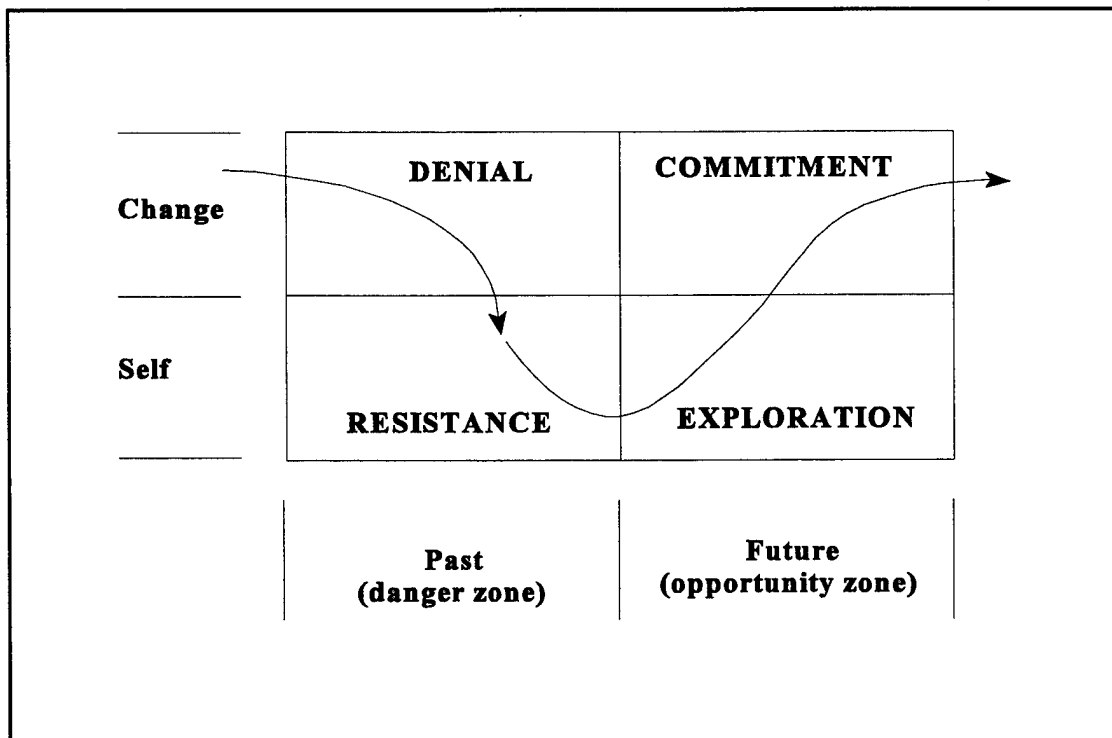
Figure 3 The Transition Curve

As change is introduced, people who believe the change represents a personal loss, will initially refuse to accept it as reality, they are in denial. They will concentrate on the past, and often doubt anything will actually change. Once these individuals accept the fact that the change is occurring they will resist the change. They will experience anger, anxiety, and self-doubt. Resistance is internally oriented, focused on feelings. Once people transition through resistance they will begin to let go to the way things were and begin to explore new options. This is a chaotic time of questioning, searching for new ways, and an openness to try new things. Because the new isn't firmly established, people uncomfortable with uncertainty have difficulty, whereas, those who welcome less structure tend to flourish. Exploration is internally oriented. Organization members should be assisted to reframe the situation by turning the problem into newly identified opportunities. Identify what you have

control or influence over and take action. Let go of things where you have no control or influence. The key is to focus on what you can do, not on what you can't do. Once the new direction is clear and the group has worked through the transition process, they are ready for commitment. This is the time to recreate the mission and build plans to make it work, to learn new ways to work together, and to renegotiate roles and expectations. This commitment will last until the next major change occurs. The end result should be to set long-term goals, concentrating on team work and focusing energy and actions where you can make a difference (Tannenbaum, 1985).

Kotter (1995) argues that it is important to plan for short-term wins in the transition. There should be clear performance objects which can be measured and when attained, the people involved should be rewarded with recognition, promotions, and possibly money. Additionally, the short-term wins can assist in maintaining a sense of urgency about the change. However, change leaders should not view the short-term wins as total victory. Instead, they should take the momentum gained through the short-term wins to carry them into bigger problems. The bottom line is that the change is successful when it becomes the normal way things are accomplished, when it is anchored into the organization's culture.

E.   SUMMARY

Information technology contains a powerful capacity that must be understood by organization management. The informating capability of information technology can only be exploited through an organization change strategy that is driven by business processes and not the technology. The organization structure, business processes and individuals, roles and skills must be aligned with information technology in order to attain the informating capacity of the technology. This alignment can only be accomplished through an integrated effort between information technology and business process specialists. For organization managers to ensure that their investment in information technology is providing increases in productivity, they must:

- Meet the challenge of creating a vision of an informated organization which can only come from managers who understand and desire to use this capacity of information technology.

- Have a clear understanding of the required organization characteristics that allow the technology to informate.

- Transition the organization through the change process with committed, competent personnel.

III. CASE: CREATING A NETWORKED ORGANIZATION

A.   INTRODUCTION

This chapter presents information obtained from archival review and personal interviews within the Naval Aviation Systems Team (NAVAIR). It describes an organization that is attempting to employ the best advise from the literature in order to ensure that its investment in information technology will result in increased effectiveness, measured in terms of improved productivity.

B.   THE NAVAL AVIATION SYSTEMS TEAM (NAVAIR)

The Naval Aviation Systems Team exists to provide the Navy and Marine Corps the highest quality aircraft, avionics, air-launched weapons, cruise missiles, unmanned vehicles, and all related equipment and support services. NAVAIR personnel oversees the life cycle of all the systems they furnish to the fleet. This life cycle begins with providing a technology base from which systems are researched, designed, developed, and engineered. Next, the systems are acquired from private industry, tested, evaluated and finally provided to the users. Once the systems are deployed NAVAIR ensures the maintenance of the systems, modifies them as necessary, furnishes the necessary supplies, and ultimately disposes of them after they reach the end of their useful life. In 1994, NAVAIR managed 17.3 billion dollars and over 200 programs. Employed by NAVAIR are over 47,000 military and civilian personnel headquartered in Washington, D.C., and located at 18 major technology and engineering centers, test and evaluation facilities, depots and logistics support activities nationwide. Ultimately, the goal of NAVAIR is to keep Naval Aviation materially ready and capable to meet the challenges it encounters.

1. Mission

The following is the Naval Aviation Systems Team's official mission statement:

The Naval Aviation Systems Team, in partnership with industry, serves the Nation and the Navy by developing, acquiring and supporting Naval aeronautical and related technology systems with which the operating forces use to train, fight and win.

2. Strategic Vision

The following is the published strategic vision of The Naval Aviation Systems Team:

The Naval Aviation Systems Team (NAVAIR) is recognized as a national asset for its role in developing, acquiring and supporting maritime aeronautical systems well matched to the needs of our Navy and Marine forces. These systems are interoperable and where possible common with the other services.

We are sharply customer and product focused. Our Integrated Program Teams led by a program manager optimize the allocation of resources over the entire life cycle of each system to meet the requirements and priorities established by OPNAV, the Fleet and the Marine Corps. Partnerships with other services and industry allow us to maximize the performance of our products and the value gained for each taxpayer dollar.

To better support NAVAIR, the people of the Naval Air Systems Command are organizationally linked by competencies spanning all sites. NAVAIR is consolidated at fewer sites to support the retention and application of our distinctive and essential capabilities at an affordable cost. We operate with defined and continuously improved processes which draw us together to transcend geographical separations.

We embrace the quality and creativity of our people as the source of our strength as we reshape and re-size to meet the future. We are committed to the training, development and welfare of our people and to supporting the transition of those who depart.

We are a team.

3. Environment

The DOD Bottom-Up Review and the Base Realignment and Closure Committees of 1993 and 1995 have called for significant reductions in the force structure and infrastructure of the United States Navy with a goal of maintaining balanced forces to fulfill

the Navy's vital mission of Littoral Warfare. This downsizing has affected NAVAIR significantly. By FY 99, NAVAIR personnel will be down to 33,000 from the current level of 47,000 and major installations reduced to 11 from the 18 currently in place. In response to the downsizing, NAVAIR initiated a reengineering effort guided by the following principles:

- Strengthen Customer Focus

- Understand and Do Only What the Navy Needs to Do

- Maintain Program and Product Focus over the Life Cycle of a System

- Develop a Seamless Team Integration with Fewer Layers

- Sustain Core Capabilities

- Operate Within Defined and Managed Processes

- Perform at Reduced Size and Cost

The basis for the reengineering effort was to radically redesign the business processes, job definitions, management and control processes, structure, and culture. The expected results of the effort was to enhance the organization's ability to deliver quality aeronautical systems despite fewer people and sites to do the job. The current adhocracy organizational structure described in the following subsection, resulted from this reengineering effort. This reengineering effort removed two layers of management and reduced numbers of employees from 55,000 in 1992 to 33,000 by 1999.

In addition to reengineering in response to reduced infrastructure and numbers of personnel, there are conditions of dynamism and complexity concerning fleet system requirements. The numbers of Navy aircraft have been reduced by 25% resulting in losses to tactical capability that must be replaced. Innovative work on upgrading weapons systems and aircraft is critical to maintaining tactical capability. In response to losses in numbers of aircraft, traditional aircraft mission areas are expanding. Every aircraft must be given multi-

roll capabilities, i.e; there will no longer be strictly fighters and bombers there will be fighter/bombers, requiring complex system modifications of many aircraft.

4. Organization Structure

It is clear that the operating environment is dynamic and complex requiring an adaptable, flexible organization. Mintzberg (1983) states:

> The conditions of the environment are the most important ones for the adhocracy configuration; specifically, the Adhocracy is clearly positioned in an environment that is both dynamic and complex...a dynamic environment calls for organic structure and a complex one calls for decentralized structure. And adhocracy is the only configuration that is both organic and relatively decentralized.

Figure 4 provides an illustration of the organization's newly implemented structure. It is based on the initiatives of the Goldwater-Nichols Act of 1986, the Defense Management Report (DMR) of 1989, and a reengineering effort in response to reductions originating from the DoD's Bottom Up Review, which began its focus on customer orientation and quality consciousness with reduced infrastructure and personnel.
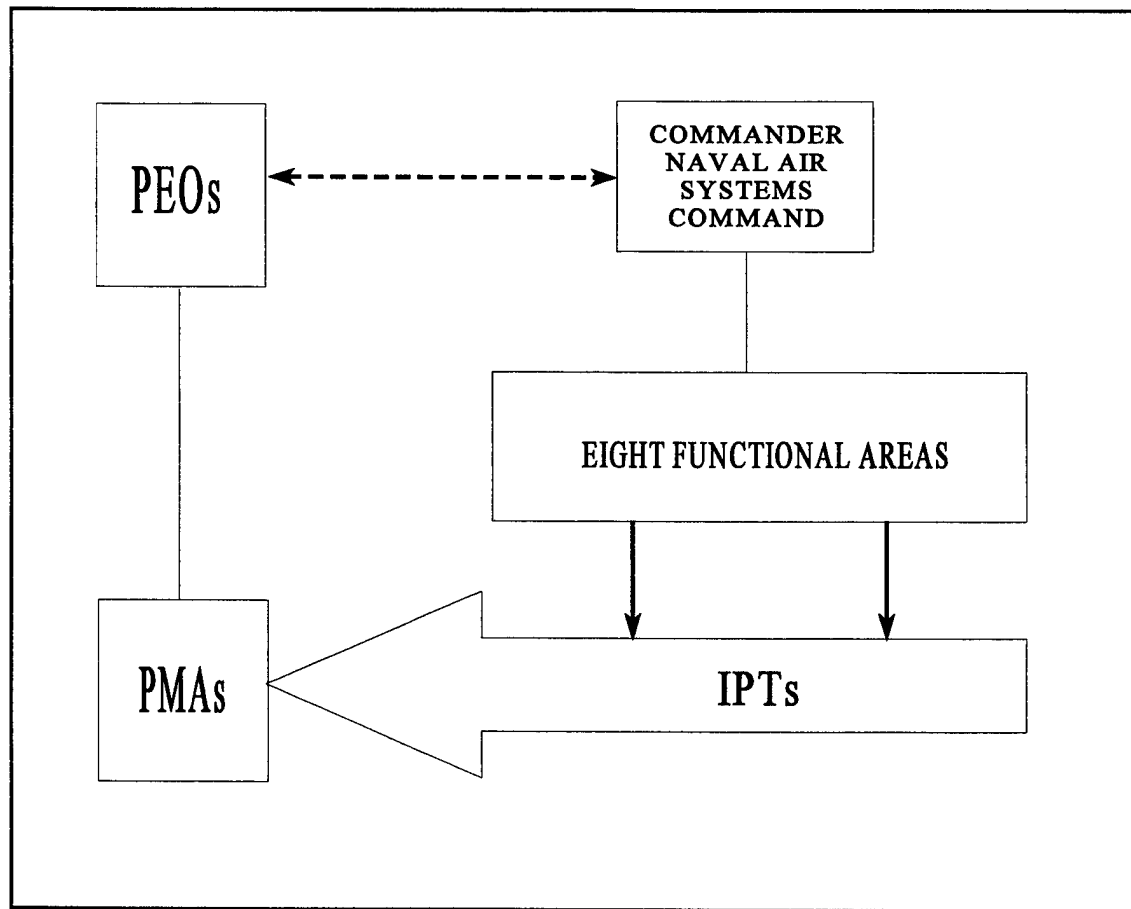
Figure 4 The Naval Aviation Systems Team Organization Structure

The new structure concentrates the best functional talent and total resources of the organization into program management teams known as Integrated Program Teams (IPTs). These new teams are fully empowered to manage their assigned programs from concept to disposal. Led by program managers, the teams have direct control over all their technical and supporting personnel. The goal is to provide the customer a more responsive agent improving the ability to control performance, cost, and schedule. The supply of skilled and knowledgeable people to the IPTs comes from functional skill areas.

This organizational structure is classified by Mintzberg (1983) as an adhocracy, which conforms to the following distinct configuration:

Highly organic structure, with little formalization of behavior; high horizontal job specialization based on formal training; a tendency to group the specialists in functional units for housekeeping purposes but to deploy them in small, project teams to do their work; a reliance on liaison devices to encourage mutual adjustment, the key coordinating mechanism, within and between these teams; and selective decentralization to and within these teams, which are located at various places in the organization and involve mixtures of managers, staff and operating experts.

The NAVAIR adhocracy incorporates a matrix structure consisting of functional areas supporting IPTs. The functional experts are grouped into the following categories:

- Program Management

- Contracts

- Logistics

- Engineering

- Test & Evaluation

- Industrial

- Corporate Operations

- Shore Station Management

A functional area consists of the people, processes and facilities necessary to provide products and services to the IPT's customers. The eight areas are linked together across all organization sites. Instead of each individual site being limited in their problem solving to on-site skills, such as engineering, they are able to rely on the engineering resources of the entire NAVAIR organization. Each functional area will have a leader who will ensure that the IPTs are supported by well trained, knowledgeable, functional area personnel.

The functional area alignment centers around a "homeroom" concept of operations. All resources of a functional area are "owned" by the functional area and are assigned by that

functional area to IPTs. When an assignment is complete, the individual returns to the functional area homeroom for further assignment. The functional groups, in conjunction with the team leaders, will ensure that resource allocation is need based and that the right people perform the required tasks. Functional area personnel have a single supervisor of record within their functional area. This supervisor performs traditional supervisory duties such as leave approval, evaluation of performance, award recommendations, development of training plans, and grievance resolution. However, an employee's work plan and performance appraisal is a shared responsibility with the IPT leaders. If an employee works on several IPTs, the functional area supervisor of record must coordinate the various work plan and performance inputs.

The implementation of the current organization structure was conducted using a phased approach. Phase 1 established the eight primary functional areas in October 1994. The mapping of people and facilities to specific functional groups, establishment of work force partnership agreements, and the selection of functional area leadership was completed during this phase. Phase 2, completed this year, formally established the IPTs within each PMA. The development of standard corporate business and reporting processes was the focus as well as the establishment of links between the organizational elements. Phase 3 is underway and is the completion of the functional area linkages across the functional matrix structure.

The NAVAIR adhocracy, incorporating a cross functional matrix of technical experts supporting program teams, is an effective structure in the current downsizing environment. NAVWAN information infrastructure is designed to provide the ability to accomplish the NAVAIR vision of a structure that transcends geographic barriers across NAVAIR sites. NAVWAN allows empowered Integrated Program Teams to use the NAVAIR knowledge specialists, throughout the entire organization, to respond effectively and efficiently to constraints placed on individual programs by the environment. The focus is on the empowerment of the IPTs to develop program specific strategy governed by general guidelines given by organization leadership. Information technology enables collaboration and communication between the functional matrix and the program offices. The NAVAIR

structure is designed to allow knowledge from the functional areas to be shared by all NAVAIR programs. The NAVWAN technology has created an enterprise network which provides the means to share information and ideas. This is consistent with the following attributes of a networked organization provided by Rockart and Short (1991):

- Shared Goals

- Shared expertise

- Shared Work

- Shared Decision Making

- Shared Timing and Issue Prioritization

- Shared Responsibility, Accountability, and Trust

- Shared Recognition and Reward

The NAVWAN information technology is aligned with the NAVAIR structure of cross functional teams by providing the organization the ability to share.

5. Individuals, Roles and Skills

The Naval Aviation Systems Team employs a group of extremely diverse individuals. NAVAIR consists of civilians and military personnel. Within these groups there are engineers, computer scientists, unrestricted line officers and restricted line officers. There are those who have worked within the Naval Aviation Systems Command organization their entire career and those that will spend only a three year tour of duty at NAVAIR. The following description categorizes the individuals within the organization based on their interaction with information technology and their position within the adhocracy structure.

a. Strategic Apex

The focus of the NAVAIR's Strategic Apex is to provide the organization vision and general operating guidelines. They have published and disseminated a mission

and strategic vision statement which clearly emphasizes the need for a networked organization. The desire to exploit information technology to enhance NAVAIR performance is documented by the Commander, Naval Aviation Systems Command's information technology goal of: "Make NAVAIR a center-of-excellence in the application of information technology".

According to Mintzberg (1983) the role of the strategic apex of the adhocracy is to be human relations experts who use persuasion, negotiation, coalition, reputation, rapport, or whatever means they have available to fuse the "individualistic experts into smoothly functioning multi disciplinary teams." Additionally, and possibly more importantly, the strategic apex must function as the organization liaison with the environment. Within the Naval Aviation Systems organization the strategic apex consists of the Program Executive Officers (PEOs), Program Managers, Air (PMAs), and Commander, Naval Aviation Systems Command.

There are three PEOs within the organization. PEO(A) for Air ASW, Assault & Special Mission Programs, PEO(T) for Tactical Aircraft Programs, and PEO(CU) for Cruise Missiles Project and Unmanned Air Vehicle project. The creation of the (PEOs) is based on DMR recommendations. The PEOs were established in an effort to streamline the Navy's acquisition chain of command. This new, streamlined chain of command runs from the various PMAs for each major weapon system to the cognizant PEO, and directly to the Naval Acquisition Executive, the Assistant Secretary of the Navy for Research, Development and Acquisition. The PEOs function primarily as the environment liaison ensuring that fleet requirements are addressed and given sufficient resources.

The focus on IPTs, fully empowered under PMA leadership is at the heart of the Naval Aviation Systems Adhocracy. The PMAs are provided the resources and requirements to manage their perspective programs from inception to disposal. They are given full management and acquisition authority including cost, schedule, and performance appraisal. The organization structure is designed to support the PMA led IPTs through the reduction and elimination of all organizational, geographical, and communication barriers. To ensure common processes throughout the organization, frequent and open

communications across programs and functional areas is essential. To accomplish this, each program will maintain liaison personnel to assist program and functional area leaders to asses and compare processes for standardization.

PMA organizations are structured to operate in an environment that is both dynamic and complex. Individual PMA structures are organic, based on IPTs managing unique, complex systems supported by functional area matrix experts. The PMAs report to the appropriate PEO and to COMNAVAIR. For example, PMA 241 (The F-14 Program) reports to PEO for tactical aircraft and to COMNAVAIR. The PEO works for the ASN RD&A. PMA 241 consists of the following IPTs, supported by teams of functional experts:

- New Technology

- F-14D

- Common Avionics

- In Service Product Support

- Recce

- Precision Strike

- Grumman Closing

- Aircraft Life Management

The Commander, Naval Aviation Systems Command, is responsible for eight functional areas, organized in a cross functional matrix, which exist to provided expert support to the IPTs.

b. Business Process Experts

The goal of every PMA is to effectively deliver and support aircraft and weapons systems to the fleet. Technology that can improve the PMA's ability to accomplish this goal is welcomed. The PMAs who's leadership supports information technology have begun incorporating information technology into their business processes, the others have

not. When asked about their use of electronic mail, one person committed: "We found out we had electronic mail through another PMA which used it. If your boss uses it, you do."

The PMAs which are incorporating information technology have begun to evaluate business process improvement enabled by technology. For example, there is an overwhelming requirement for signature authority on official documents which currently requires hard copy printing and routing for signatures. NAVWAN could provide an improved way of doing business in this regard. When a modification is made to an aircraft or a new part is installed, NAVAIR must issue formal flight clearance for the aircraft to fly with the modification or new part. These flight clearances include information from multiple functional area experts. PMA members currently using information technology, expressed a requirement to generate these documents by having software to include people in Patuxent River, China Lake, the PMA, or any other functional area, to simultaneously work on the information via NAVWAN. This would require implementing digital signature authority, which is a capability currently being researched for implementation.

In contrast to a PMA with information technology support from senior leadership, another PMA member required a database application which allowed storage of data on aircraft flight mishaps. Without having PMA support, he was forced to develop the application on his own and the result is a proprietary application, which only he uses.

The consensus within the PMAs is that the majority of users aren't smart enough to define what their information technology requirements are. The result is they accept what they are given by the computer technologists. The common perception within the PMA of the technology specialists is: "the computer guys have the attitude of, just use what we give you." The majority of PMA users feel what needs to happen is for the technologists to find out what the users need by obtaining an understanding of what their work consists of.

c. Information Technology Experts

The role of the information technology experts is to develop the NAVWAN infrastructure that provides NAVAIR connectivity across all geographic locations. Their emphasis is on infrastructure and assisting NAVAIR members in developing program

specific information technology systems which can access NAVWAN. The NAVWAN teams are chartered to set NAVAIR information technology standards and to take a snapshot of where each NAVAIR site is today in relation to those standards. To accomplish this, surveys have been completed by all NAVAIR sites. The survey questionnaires used are included as an Appendix to this thesis. This data was collected and used to develop plans for Divisions, the Depots, PEOs and PMAs to fund and execute.

The focus of the information management personnel is to provide electronic mail and file transfer capability throughout the NAVAIR. All other program requirements are to be solved within the responsible program office with the assistance of information management personnel.

The traditional role of information technology professionals was that of technology implementation. In the NAVAIR networked organization, that focus is too narrow. The technology experts must function as implementors and educators. There is concern that people involved in day to day work don't have the time or resources to learn how to use the information technology available to them. One comment was: "How can I tell someone what technology I need when I don't fully understand how to use what I currently have." The information specialists must work to understand the business processes employed within other areas of the NAVAIR, so that they are able to apply their technology expertise in a way that adds value to existing processes. They must attempt to integrate their efforts with the business process experts to achieve the highest level of technology support. This integrated effort will produce managers who are both comfortable and literate in information technology, making it easier to identify and pursue opportunities, and emerge as champions with the vision and leadership to move the organization into the right direction.

6. Management Processes

NAVAIR management processes are driven by the principles and methodology of Total Quality Leadership (TQL). The commitment to TQL is evident by the NAVAIR's management goal of "making TQL continuous improvement a way of life throughout the NAVAIR by the year 2010". This commitment is consistent withe the required organization characteristic of continuous learning presented by Haeckel and Nolan (1992). NAVAIR

employs a Quality Management Board to focus on customer feedback. Process Action Teams are chartered by the Quality Management Board to address specific TQL problems or issues. Process Action Teams focus on developing methods to monitor NAVAIR processes, collect data from the monitoring system, analyze the data, and make change recommendations which improve business processes and eliminate low value functions. Figure 5 illustrates the TQL Plan, Do, Study, Act Cycle, used by every NAVAIR program to evaluate business processes. This tool works to enhance organizational learning, which is critical for successful process improvement. The key to organizational learning is establishing good measures which uncover the details of the processes. From these details, questions can be asked concerning the nature of the processes which will lead to process improvements. NAVAIR management must continue to focus attention on organizational learning. NAVWAN provides technology that allows the learning curve to accelerate, without it, the potential for a premature learning plateau is great.
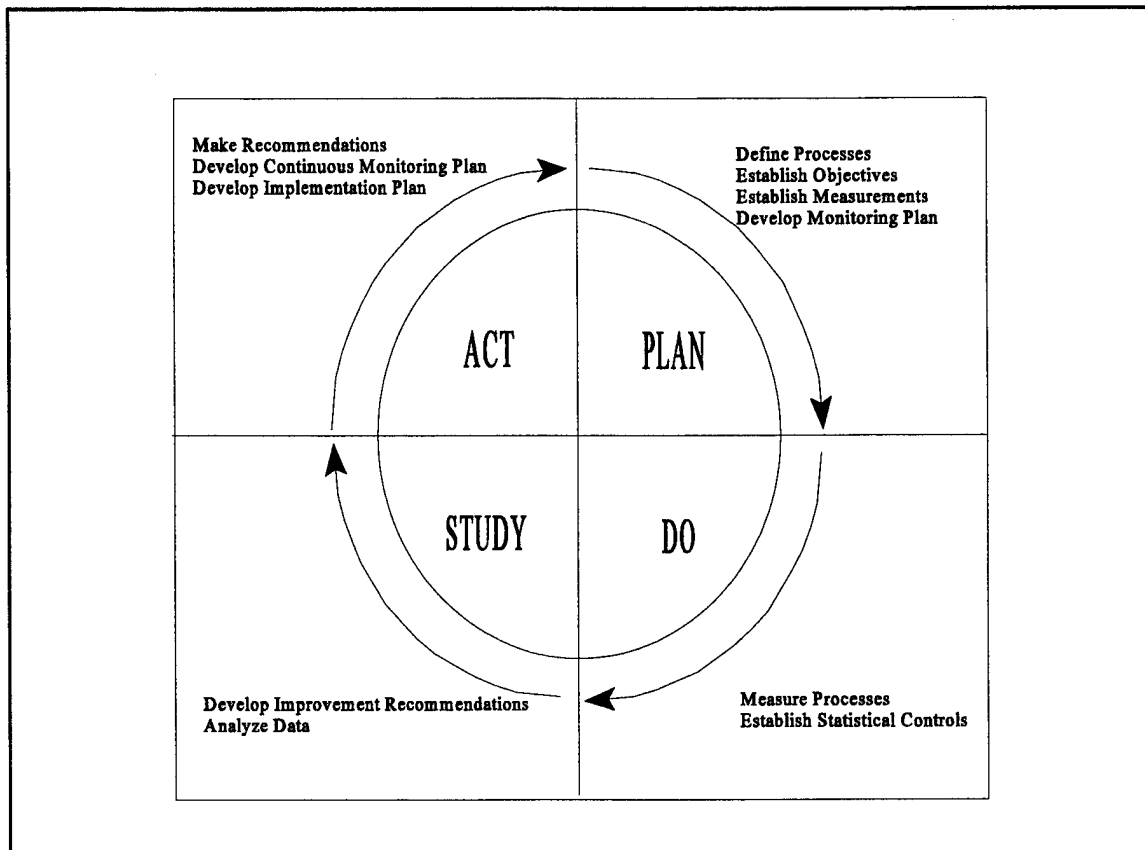
Figure 5 TQL Plan, Do, Study, Act, Learning Cycle

7. Organization Strategy

The decision to commit resources and set plans for decision making within the Naval Aviation Systems Team is ultimately based on environmental constraints. For example, as a result of decreases in funding, the decision was made to disestablish the medium attack community and to modify existing fighter aircraft to fulfill the resulting loss in tactical capability. This decision making about specific programs, might normally be considered program implementation, but this is how strategies emerge within an adhocracy. Because the NAVAIR adhocracy functions within a complex and dynamic environment, strategy decisions are best described as opportunistic reaction. Mintzberg (1983) terms this process

strategy formation, which accurately describes the Naval Aviation Systems Team's strategy making processes.

The focus on PMA led IPTs, fully empowered to commit resources, illustrates that strategy making is a diffused process in the NAVAIR's adhocracy, as opposed to a Machine Bureaucracy where strategy decisions are controlled by the strategic apex. Within The Naval Aviation Systems Team, the strategic apex manages the process of strategy making without specifying the content. Additionally, they provide general guidelines for strategy making, a process Mintzberg (1983) terms "umbrella strategy". Mintzberg further describes the umbrella strategy as: "the building of image or ideology, the creation of missionary zeal".

The NAVAIR's umbrella strategy consists of four parts:

- <u>Team Integration</u> - Integrate and streamline the activities that compromise The Naval Aviation Systems Team and focus the best talent on managing the development, acquisition and logistics support of aeronautical systems.

- <u>People</u> - Attract, train, take care of and retain quality personnel.

- <u>Jointness</u> - Ensure all weapons, aircraft, airborne equipment, and support systems are integrated and interoperable and to the maximum extent possible common to those used by the services over the life cycle.

- <u>Acquisition Management</u> - Continually improve our acquisition process to provide our customers with technically superior aeronautical weapons systems.

Figure 6 illustrates organizational leadership's role in dealing with environmental constraints. These constraints drive the organization's strategy development. The formal leadership must work to influence both sides through negotiation with the environment and providing a general umbrella strategy for the organization to follow.
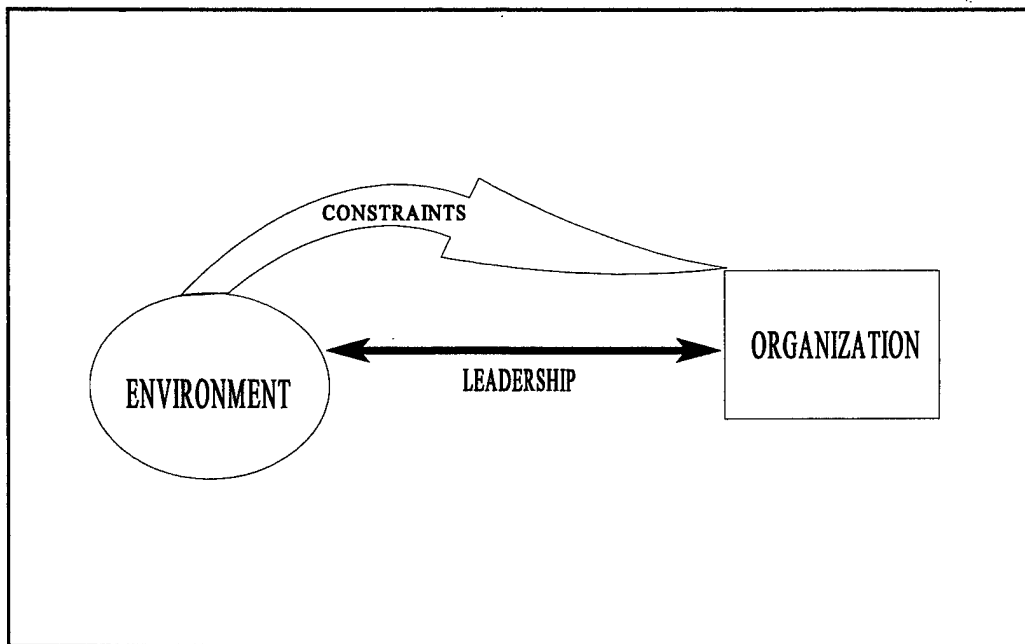
Figure 6 Environment Driving Strategy

The NAVWAN allows the strategic apex to disseminate the umbrella strategy throughout the entire NAVAIR. This ability to share organizational goals and objectives is provided by NAVWAN and is considered a critical enabler of the TEAM strategy of team integration.

C.   NAVAL AVIATION SYSTEMS TEAM WIDE AREA NETWORK (NAVWAN)

NAVWAN was initiated in 1991 as a Naval Aviation Systems Command headquarters local area network (LAN) employing a super server. NAVWAN currently has over 3500 users at the head quarters LAN and over 28,000 people in the wide area directory. The NAVWAN provides the communications and information management infrastructure that supports the reengineered NAVAIR, and its operating concept employing Integrated Program Teams and a functional area aligned organization. The Corporate Operations

functional area is responsible for supplying the NAVAIR with the required information management infrastructure providing the most advanced communication available.

1. Description

NAVWAN provides an infrastructure that supports a common, multi-purpose, standards-based information technology capability. The architecture builds upon the technology and procedures developed and tested under the NAVAIR Headquarters Local Area Network (LAN) and the Naval Air Warfare Center LAN. NAVWAN supports an open system architecture and a standards-based framework that is compliant with Defense Information Systems Agency (DISA) standards, Government Open Systems Interconnection Profile (GOSIP) and Portable Operating System Interface for Computer Environment (POSIX). The result is a system that offers interoperability, portability and scalability. NAVWAN is designed to be responsive to the NAVAIR core user requirements, as well as the more demanding scientific and database requirements.

2. Levels of Connectivity

Connectivity across the Headquarters and the multiple NAVAIR sites is underway with 75% complete and the remainder on line by FY97. The program is comprehensive and addresses three levels of connectivity:

- Wide Area Network (WAN) - telecommunications lines between sites using long-haul circuits. The type of lines (e.g., T-1 and 56K or PVC Frame Relay) will vary with the user bandwidth/usage requirements.

- Local Area Network (LAN) - connectivity within sites through backbones, bridges/routers and gateways. The type of line/hardware will vary with user requirements.

- Computers, peripherals, software and services at the individual desktop. The type and capability will vary with user requirements.

3. Activities Connected

NAVWAN connectivity includes the NAVAIR Headquarters (including PEOs), all of the Naval Air Warfare Centers (NAWCs), the Naval Aviation Depots (NADEPs),

Aviation Supply Office (ASO), Naval Air Technical Services Facility (NATSF), Naval Air Engineering Support Unit (NAESU), Naval Aviation Maintenance Office (NAMO), Naval Aviation Depot Operations Center (NADOC)., and Naval Air Pacific Repair Activity (NAPRA).

4. Network Management and Operations

Two Network Management Control Centers (NMCCs) will be established to monitor the network and coordinate system operations. NAWCAD Patuxent River and NAWCWD China Lake will provide NMCC services.

5. Interoperability

The NAVWAN is designed to support application-to-application standardization and standardized business processes across the system.

This year the following has been provided:

- Messaging capability complete with binary attachments which are viewable from within the Messaging application, or directly executable from within the Messaging system.

- A directory service integrated with the Messaging system which can be used to look up and address a message to any member of the NAVAIR.

- A file transfer mechanism which is independent of the network operating system used at each of the team sites and which is accessible by every member of the NAVAIR.

- Implementation of gateway solutions for site integration with the NAVAIR. Where the associated support costs were excessive, consideration was given to replacing a site's messaging and file sharing system

The long-term goal is to migrate to a state-of-the-art, standards-based system by 1997.

6. The Technology Vision

The NAVWAN is considered by the information management functional area specialists as the NAVAIR's version of the information super highway. The NAVWAN

Program Manager stated: "NAVWAN is building the Interstate and paving "off-ramps" to NAVAIR sites."

The NAVWAN program was inspired by a vision that NAVAIR members should be able to communicate easily using computers across the country, or the world, without regard for the distance separating them, or the different computer equipment which they may be using. To do this requires an infrastructure, hardware, and software to be made available to NAVAIR users.

This vision was explained as having two employees who use different computers, i.e., one using a Macintosh the other a Personal Computer, to have the ability to look for each other's electronic mail address in an on-line electronic directory. Then, they send e-mail to each other, and after receiving this e-mail, launch common business application attachments like a word processing document or a spreadsheet, without requiring advanced information technology training.

7. Implementation

When implementation planning first began the initial concept was to use traditional System Development Life Cycle (SDLC) management. However, the scope and depth of NAVWAN implementation issues required integration of all NAVAIR information technology expertise resident at the NAVAIR field sites and headquarters. A senior NAVAIR civilian involved in NAVWAN implementation states: "We, NAVAIR, must stop thinking of stovepipes and rice bowls and start thinking cross functional organization support with emphasis on operating teams managing the entire life cycle of a program, in this case, NAVWAN." The result was NAVAIR representatives from headquarters and the field activities forming a management team and developing the NAVWAN implementation approach.

Strong, centralized management was chosen to meet complex requirements for network interoperability and DISA technical standards compliance. An Enterprise Team (ET) was formed for NAVWAN implementation by designating members from both headquarters and the field sites. The NAVWAN ET is comprised of personnel with expertise

in specific information technology areas. ET members perform NAVWAN duties concurrent with existing job tasks. NAVWAN tasking holds equal priority with normal job duties.

The ET consists of five product teams corresponding to the following product areas:

- Wide Area Network Connectivity

- Local Area Network Infrastructure

- Network Operating System

- Tools and Applications

- Fleet Prototype Demonstration/Validation

Each team is responsible for the impact of its product from inception through implementation, across the three levels of infrastructure (WAN, LAN & desktop computing), and address requirements in all of the following product milestones:

- Requirements Definition

- Design

- Test

- Implementation

- Configuration Management

- Operation

- Security

In an effort to ensure common processes between the various products, and to prevent duplication of effort, staff advisers are designated to assist product managers and to perform horizontally across the team management structure. The key to success is regular and effective communication. This is accomplished by using weekly video teleconferences, electronic mail share folders and periodic program reviews.

D. SUMMARY

This chapter has provided the NAVAIR organization background concerning the realignment into a cross-functional adhocracy supporting Integrated Program Teams controlled by Program Managers. It has also described the information technology in place to support the organization and how the organization is complying with the best practices from the literature on organizations and information technology. Chapter IV will provide analysis of the research with emphasis on interviews conducted with business process experts working within program management, and information technology experts working within the corporate information management functional area.

IV. CASE ANALYSIS

A. INTRODUCTION

This chapter presents an analysis of the Naval Aviation Systems Team's change effort and the implementation of new information technology. The focus of the analysis is on the problems encountered which create obstacles to management's attempt to increase organizational effectiveness and productivity through the use of information technology.

B. PROBLEM IDENTIFICATION

The following problems are based on the author's personal analysis of data gathered from interviews with members of the Naval Aviation Systems Team. The problems listed were not specifically mentioned by those interviewed, but are the author's opinion based solely on a cross-sectional view of the organization. A longitudinal case study, including observations and personal interviews, would be required to determine the accuracy and magnitude of these problems.

1. Lack of Teamwork

Katzenbach and Smith (1993) distinguish teams from workgroups by the way work is accomplished. Within a team, the work of two or more people is combined in a way that enhances performance levels beyond what is attainable by the sum of the team members. The concept of shared/collaborative work is crucial in obtaining the maximum increase in organization productivity through the use of information technology. However, interviews indicate that the majority of work accomplished within the organization is not in accordance with this paradigm. The organization places emphasis on meetings which provides an opportunity for individuals to share insights and perspectives, and to establish program plans of action and milestones. Work is still accomplished by individuals, not collaboratively by team members.

Within the Naval Aviation Systems Team, there is a desire to accomplish work as a team. The organization vision states: "We are a team". Senge (1990) points out that "people

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do not (always) behave congruently with their espoused theories (what they say), they do behave congruently with their theories-in-use (their mental models)". The mental model that dominates is one of individual work.

There exists a requirement for signature authority for team outputs. The teams must submit their outputs through various individuals for approval. This reenforces the hierarchical mental model of how business is conducted. One individual interviewed characterized the transition to a team-based organization as "trying to put old wine in new bottles". This illustrates a lack of awareness of what teamwork is all about--collaboration-- and results in resistance to teamwork. A reason for this resistance to teamwork is explained by Reger and others (1994) as due to a failure to fully comprehend the meaning of the change.

There exists an institutional mental model of a team in accordance with what Katzenbach and Smith (1993) consider a work group. Work groups focus on improving individual performance of its members through group discussions, debate and information sharing, but do not accomplish real work together. The teams within this organization are best described as work groups.

2. The Loss of Power

Those that do not understand information technology are threatened by its use. They do not use the technology and are often excluded from exchanges of information or correspondence that takes place over the network. Those interviewed mentioned situations that occurred when a senior officer used electronic mail to obtain information from subordinates. People within the chain of command that did not use the information technology were often bypassed by the commander who would correspond with people further down the command chain, who were technology users. This created tension, because the people in the middle were being eliminated from the process, because they didn't use information technology. This highlights a shift in organizational power from positional power to knowledge power.

There were instances when different NAVAIR sites were given network capability before others. There was animosity between sites, "Why is that site getting electronic mail and my site hasn't." Unfortunately the answer was typically: "Because your commander has not given information technology priority."

There were situations where some PMAs had available resources prior to the NAVWAN, and had developed their own proprietary network solutions, software, hardware and personnel support. These PMAs viewed the transition to NAVWAN as a loss of control and in some cases a loss of capability. There were a few groups that had direct connections to contractors via proprietary networks, the NAVWAN provided Internet capabilities, but proprietary connections were not available.

These examples illustrate that, those who feel they have something to lose, typically power or control, will resist the change. The implementors of new information technology, whether they know it or not, are change agents. They must be prepared to answer the question: "What is this technology going to do for me?". They must realize that those who feel threatened by the technology, those who feel they have something to lose by its implementation, will probably resist its use.

The old paradigm empowered those who held formal positions. The new paradigm is authority based on knowledge. The emphasis on program teams requires that the focus shift to knowledgeable, empowered team members, who are given authority to manage their programs based, not on their position in a hierarchy chart, but on their particular expertise applied to a specific program. Under this paradigm, senior military officers share decision making with team members, possibly junior civilian engineers working within the same program team. The new social system will emphasize shared authority within teams, as opposed to positional authority.

3. Culture Gap

The common cultural makeup of the Naval Aviation Systems Team centers around traditional hierarchial organization relationships. This culture does not fit with the cultural requirements of a networked organization. Relating to information technology, there is a

noticeable culture gap within the organization. "The young sailors out there have grown up with technology. They all have personal computers and know how to use them". They are part of the cyberspace culture and the majority of the senior leadership at NAVAIR, both civilian and military, are not. "We have to deal with senior officers who view technology as something that gets in their way. They refuse to see the value technology brings to the table." "Too many senior officials are not technology savvy, they live with the VCR constantly blinking 12:00." "The cyberspace community is rank neutral, many senior leaders can't deal with the fact that an E-3 can send electronic mail to the Admiral." "We know of 0-6s and GM-14/15s who don't touch a computer. They have their secretaries make hard copies of electronic mail and post it on their message boards." The success of NAVWAN is based on a partnership with the users, but some organization leaders are not willing to support information technology because it does not fit their hierarchical culture.

4. Lack of Technology Resources

Some users have older equipment, like 286 processor machines which can't run Windows or electronic mail packages. Some get to electronic mail only by using a terminal to mainframe computer. In some cases, local area networks haven't reached the commands. Some people have to walk down the hall or go across the ramp to another hanger to even see a PC. If people are going to be able to drive on the information superhighway, they need a "car" to drive and a "street" (without potholes) to drive on that gets you to the NAVWAN Interstate ramp. Project team members have been working to put the NAVWAN network, the Interstate, in place, while building ramps at most NAVAIR sites. NAVWAN teams are assisting the Divisions, the Depots, and local commands by developing plans to help get all the required pieces in place. NAVWAN teams are using site survey questionnaires to document what information technology exists and then making recommendations for changes. The survey questionnaire used is included as an appendix to this thesis. But many locations have aging cable plants that cannot support higher speeds or higher capacity of the emerging corporate requirements. Some areas of bases and stations need new network

connections and other sites have "islands" of networked computers which cannot interoperate with other "islands," even on the same base or stations.

There also are problems with document configuration, hardware and software incompatibility. Many PMA members expressed interest in having NAVWAN facsimile and naval message capability. These are issues that NAVWAN managers are currently addressing but have not yet been solved.

Everyone interviewed emphasized the need for training. NAVWAN program managers are constantly working to provide on-site user training. A user help desk is operational providing assistance in solving information technology problems. Perhaps the most effective training is on the job training. Those PMAs who support information technology have made efforts to ensure personnel are sufficiently trained, the others are not. The use of information technology will only enhance employee productivity if the concept of continuous training is embedded into the NAVAIR culture. Without it, the technology will only inhibit user's performance, due to their lack of technology understanding.

C.   SUMMARY

This chapter has provided the author's description of the problems within the organization that create obstacles to informating. The essential element of the networked organization is Drucker's (1988) concept of information responsibility. The NAVWAN provides the technology that eliminates time and geographic constraints. NAVWAN program teams are working to provide the technology to all sites, but are not yet complete. NAVWAN allows the sharing of information, knowledge and ideas, to those NAVAIR sites with access. However, unless the social system emphasizes team performance over individual performance, knowledge authority over positional authority, and collaborative work over individual work, the NAVWAN technology will not work to informate the organization, at best, the result will be automation.

V. CONCLUSION

A.   RESEARCH QUESTION

This thesis has provided a thorough literature review and a DON organization case study to provide an answer to the research question: How can organization managers ensure their investment in information technology will increase effectiveness measured in terms of improved productivity? The literature review has given an academic answer while the case study has documented actual implementation of information technology within a DON organization. The answer is composed of three parts. First, management must understand the power of information technology to provide improvements to business processes through its informating potential. Second, management must understand the required organization characteristics that enable the information technology to informate as opposed to automate. Finally, from this understanding, a vision of the informated organization is required to then guide the organization into a change effort which uses information technology to increase organizational effectiveness and improve productivity by enabling a reengineering of business processes.

B.   SUMMARY OF CHAPTERS

The literature review describes the ability to learn the meaning of the data generated by information technology, to gain insight into the processes being accomplished within an organization. The term informating was coined by Zuboff (1988) to describe this ability. If the organization's goal is to exploit this potential of information technology, managers must understand this capability and be willing to change certain organization characteristics which are described as the "people issues," or the forces which contribute to a culture that is able to transform itself into an informated, knowledge-based organization.

The characteristics discussed are structure, business processes, and individuals, roles and skills. Drucker (1988) states that in an information-based organization, the majority of knowledge will reside where work is accomplished. The workers will be specialists who push knowledge up to management. This shift requires new job skills and changes the way

jobs are linked within an organization. The informated organization will employ a team-based organizational structure requiring traditional boundaries between functional areas to erode and give way to tighter integration across functions and tighter interdependencies of activities. In order for organizations to take advantage of information technology they must invest in user training and teach the informated vision required to exploit the technology.

The case study provides insight into the implementation of the NAVWAN information technology within the Naval Aviation Systems Command. The results of archival research and interviews within the organization highlights how the organization is implementing the best practices found in the literature. The case analysis also presents problems encountered that present obstacles to exploiting the informating potential of the information technology. The majority of problems are found within the NAVAIR social system: the lack of teamwork, the loss of power, and an information technology culture gap are given as problems that could prevent the NAVWAN information technology from increasing organization productivity through its informating potential.

C.   RECOMMENDATIONS

The Naval Aviation Systems Team vision states: "We are a Team". However, organization behavior indicates that the institutional teamwork paradigm, or mental model, does not support the requirement of collaborative work of team members. There must be an effort to change this mental model to focus on collaborative teamwork. Teamwork must become part of the organizational culture, supported by senior management through rewards and recognition of teams and not individuals. The organization vision should state that NAVAIR is composed of teams; teams of knowledgeable specialists that share resources, decision making, and rewards, and does real work together. Unless this change occurs, the information technology will not contribute to its full potential.

Resistance to change within the organization results from the shift of power and control from hierarchical positions to knowledgeable, empowered team members. Empowerment is no longer based on formal positions, but on knowledge and expertise applied to specific programs. Additionally, the information technology culture gap creates

resistance to the NAVWAN technology by those who do not understand the technology, and are uncomfortable with its use. This resistance should be dealt with by establishing a coalition of program management experts, information technology specialists, and external organization development experts. This coalition should work to develop a plan that combines the needs of program management, team orientation, and the informating capability of information technology. This plan should be used to guide the organization through the change effort. The first requirement is to educate senior leaders and program management experts on the potential power of information technology to improve their business processes. The information technology culture gap can be eliminated through this education. Then, the coalition should deal with the resistance from organization members by ensuring they understand their own and others, response to change. Organization members should be assisted to reframe their situation by turning their resistance into new opportunities, focusing on what they have control over as opposed to where they have no control. This plan should assist the organization in transitioning through the change to a team-based structure, enabled by information technology.

D.   VALUE CONTRIBUTION

This thesis has shown that technology, no matter how well designed, will not improve organization effectiveness and productivity alone. It must be integrated into an organization by managers who are knowledgeable about the technology and its alignment with key organization forces, specifically, structure, business processes and individuals, roles and skills. Then, the organization must transition through a change effort managed by committed, competent personnel, with a guiding vision of improving business process using the informating capacity of information technology.

The importance of integration between information technology specialists and business process experts early in the implementation of information technology is critical. This is the only way to solicit support from senior leadership and business process experts. They must be made aware of the value of information technology and the tools it provides for business process improvement. It is incumbent on the information technology specialists

to break from the traditional mentality of simple providing a technology solution. They must work to integrate with business process experts by first educating them on the value of information technology. This will result in business process experts acting as champions of information technology and developing strategies, structure, and processes which incorporate its use. Secondly, the information technology specialists must strive to understand the processes that the technology is intended to support and improve. This understanding will ensure that the technology solution is the best available. Without this integrative approach, the potential value contribution of information technology may not be realized until the current generation of leaders are replaced by those who have been educated and trained in information technology. The technology is available, but it will not informate an organization as described by Zuboff (1988), without attention given the human elements. That is the challenge of management.

The proliferation of information technology affects many levels within an organization. The implementation of information technology with a goal of business processes improvement should be an organization priority. To ensure their investment in information technology will increase organization productivity, organization managers must strive to provide the following:

- A vision articulating the need to improve, visibly supported by senior leadership.

- An organization strategy which integrates information technology.

- An organization structure which allows the development of empowered teams of knowledgeable workers, sharing resources, goals and rewards.

- Management processes focused on continued improvement through organizational learning.

- Individuals who are well trained and empowered to act on their own initiative and rewarded for their contribution to organization improvement through teamwork and information responsibility.

- An information technology infrastructure which allows sharing of resources between teams and within teams, transcending geographic and time constraints.

This is the framework management must follow in answering the question: How can organizations ensure that their investment in information technology will result in increased effectiveness leading to improved productivity?

E.   FURTHER STUDY

This thesis assumes that the organization goal is process improvement through information technology. There are organization scenarios where the goal of automation would be preferred over informating. Organizations which are hierarchically structured, such as a machine bureaucracy, with routine, proven business processes, may not benefit from an attempt to informate. Opportunity for further study exists in determining what type of organization can best benefit from the recommendations provided in this thesis for the implementation of information technology.

APPENDIX. SITE SURVEY QUESTIONAIRE

The following survey was used by NAVWAN program teams to assess the information technology status of TEAM organizations.

Site WAN Questions

W1. Who is responsible for WAN configuration management at your site?

(Please specify Name, Phone#, Fax#, Code, Mailing address, and EMail address.)

W2. Do you have configuration management procedures?

(If so, please attach and label "Attachment W2".)

W3. Do you have drawings and/or other documentation showing

the wide area networking configuration of your site?

(If so, please attach and label "Attachment W3.)

W4. What circuits to external networks are currently installed? For each of these circuits please describe the circuit type, bandwidth, transport protocols, routing protocols, point of contact.

W6. Do you have a connection(s) to INTERNET?

(If so, please describe.)

W7. What services (or capabilities) does your site require from a wide area network? For example, does your site require high bandwidth to support graphic imaging? secure communication links for classified data? links to mobile platforms?

W8. Does your site have a Domain Name Server (DNS)? What is its name and TCP/IP address?(129.12.x.x, 2-1999, etc.)

W9. Does your site exchange e-mail with other sites?
(If yes, please describe the mechanism(s) of external mail transport for each mail system.)

W10. List the POCs for Wide area networking issues at your site?
(Please specify Name, Phone#, Fax#, Code, Mailing address, and EMail address.)

W11. Who is the network security officer at your site?

W12. Does your site have network security procedures?
(If yes, please attach and label "Attachment W12".)

W13. Do you have a help desk for wide area networking issues?
(If so, please specify Phone#, EMail Addr, etc.)

W14. Who runs your existing wide area networking facilities?
(Please specify Name, Phone#, Fax#, Code, Mailing address, and EMail address.)

W15. What are your expections of and current usage of your IM system and what would you want NAVWAN to support in the future?

W16. Will NAVWAN resolve an existing problem at your site?

W17. The NAVWAN project will open a line of communications to other sites. Are there any risks, security problems or any other problems in opening up communications with other sites?

W19. What should be done to increase awareness/understanding of NAVWAN functionality at your site, e.g., product announcement, advertising campaign, training schedules, advance documentation, etc.?

W20. Briefly describe the major concerns you see that could hamper the implementation of NAVWAN at your site.

W21. Do any of your LANs provide data encryption? (Same as L13/N9)

W22. Do any of your LANs handle classified data? (Same as L14/N10)

W23. What mail systems does your site currently use?
Which is the preferred system? (Same as L21)

W24. What servers are installed in each of your LANs and what
services do they provide(TCP/IP, APPELETALK, NOVELL IPX, ETC.)?

W25. Infrastructure cable system: What is your outside cabling plant comprised of? (Fiber, COAX, Thick/thin broadband, twisted pair, cat3/5, ibm type, STP/UTP, others? (Same as L24)

W26. What is your inside cable plant comprised of? (Same as L25)

W27. Do you have automated fault notification? (Same as L34/N17)

W28. Do you have automated net intrusion monitoring? (Same as L35/N18)

W29. Do you have any Long Haul/External Circuits, how many, what kind, are they documented, project/program association, origin/dest, ownership/responsibility, and POC? (Same as L36)

W30. Describe any planned and funded network installations, removals, or upgrades for the next 24 months. (Same as L40)

W31. Please supply a high level network diagram for the corporate LAN backbone structure.

W32. Do you have a complete set of diagrams showing cabling, workstations, and servers on your LANs? Please attach and label "Attachment W32". (Same as L42)

W33. Do you have a list of critical, important users? (Same as L43)

W34. Other than personal computers, what manufacturers and models of computer systems are connected to your LANs? (Same as L45)

W35. How many buildings are connected? (Same L46)

W36. Typical building construction; multi story, single story, sq/ft? (Same as L47)

W37. How many buildings have LAN connectivity? (Same as L49)

W38. How many more buildings need network connectivity? (Same as L50)

W39. How many buildings need an upgrade to their network? (Same as L51)

W40. How many buildings have available fiber optic cable installed? (Same as L52)

W41. What type of network diagnostic equipment is available? (Same as L53)

W42. What backbones do you currently have installed? Which of
your LANs are connected to this backbone?

W44. What Network Management Tools do you currently use? (Same as L59)

W45. What type of LAN topology is used? (Same as L64)

W46. What is your annual expense for LANs at your site?
(Include all cost as defined in Life Cycle Management.) (Same as L69)

W47. What "fire-walls" or security router do you currently have protecting your LANs?
(Same as L70)

W49. Is remote access to your mail systems supported?
If so, by what methods?

Site LAN Questions

L1. Are any of your LAN connected personal computers running in a "disk-less" mode and,
if so, what hardware/software do you use to provide mass storage capabilities?

L2. Are you planning to consolidate to one major type of personal computer?
(If so, attach a copy of this plan and mark it "Attachment L2").

L3. Do you use your LANs to facilitate the backup of personal computer data?

L4. How is data on your personal computers backup up?

L5. Provide a copy of your documents for security on personal computers.
(Please mark these documents "Attachment L5").

L6. Are any of your workstations being used in a client/server environment?
(Same as N1)

L7. Does your LAN have access to the internet? if yes, is it via host or router/gateway connection? What outside networks is your LAN Connected to?

L8. Are you connected to a WAN?
(SPLICE, DDN(MILNET) FTS-2000, CONTRACTOR CONNECTIONS, DREN, NCPDS, OTHERS)
Who is your P.O.C?
What protocols are used (Routing/Transport), hardware connectivity and software version?

L9. What protocols are supported on your LAN?
(TCP/IP, DECNet, IPX, XNS, AppleTalk, Banyan, OSI, NetBEUI, SRB, other)

L10. Does your site run high network bandwidth applications? (VTC, Desktop video, ISDN, Modeling/sim/data acquisition/reduction imaging)
Are these sharing a common media? What type?

L10.1 What NOS(s) are used on your LAN(s)? Include versions.

L11. For each NOS list the servers and services provided.
(i.e. file servers, print servers, facsimile servers)

L13. Do any of your LANs provide data encryption? (Same as W21/N9)

L14. Do any of your LANs handle classified data? (Same as W22/N10)

L15. Do you currently have a site wide bulletin board system?
What is the make and model of this system? (Same as N11)

L16. Do you have any wire-less LANs?
If so, how have you provided for data security?

L17. Do you have one site-wide mail system that is available to all your LAN users? (Same as N12)

L18. Do you support any synchronous traffic such as IBM 3270?

L19. Do you support off-site access to your LANs?
If so, what type of access? How do you provide security for this access? (Same as N13)

L21. What mail systems does your site currently use? (Same as W23)

L23. What software do you distribute via your LAN? (Same as T2/N16)

L24. Infrastructure cable system: What is your outside cabling plant comprised of? (Fiber, COAX, Thick/thin broadband, twisted pair, cat3/5, ibm type, STP/UTP, others? (Same as W25)

L25. What is your inside cable plant comprised of? (Same as W26)

L26. What are the lengths of your LANs?

L27. Who is your POC for your cable plant?

(Please specify Name, Phone#, Fax#, Code, Mailing Address, and EMail Address.)

L28. Is your cable plant documented?

If so, please attach and label "Attachment L28".

L29. Is your inside cable plant self-owned?

L30. What is your interface to the desktop?

(AUI cable, twisted pair, fiber, coax)

L32. Who provides LAN Administration?

(Please specify Name, Phone#, Fax#, Code, Mailing Address and EMail Address.)

(Same as CM20)

L33. Do you have a Network Control Center?

If so, what services does it provide? (Same as CM21)

L34. Do you have automated fault notification? (Same as W27/N17)

L35. Do you have automated net intrusion monitoring? (Same as W28/N18)

L36. Do you have any Long Haul/External Circuits, how many,

what kind, are they documented, project/program association,

origin/dest, ownership/responsibility, and POC? (Same as W29)

L37. Do you provide a "help desk" for your LAN users? (Same as N20)

L40. Describe any planned and funded network installations, removals, or upgrades for the next 24 months. (Same as W30)

L42. Do you have a complete set of diagrams showing cabling, LAN backbone structure, workstations, and servers on your LANs?
If so, please attach and label "Attachment L42". (Same as W32)

L43. Do you have a list of critical, important users? (Same as W33)

L44. What kind of data do you keep on LAN failures? Can you generate reports from this data? If so, please provide your last report and label it "Attachment L44".

L45. Other than personal computers, what manufacturers and models of computer systems are connected to your LANs? (Same as W34)

L46. How many buildings are connected? (Same as W35)

L47. Typical building construction; multi story, single story, sq/ft? (Same as W36)

L48. Do you charge users for connectivity/use? If so, how?

L49. How many buildings have LAN connectivity? (Same as W37)

L50. How many more buildings need network connectivity? (Same as W38)

L51. How many buildings need an upgrade to their network? (Same as W39)

L52. How many buildings have available fiber optic cable installed? (Same as W40)

L53. What type of network diagnostic equipment is available? (Same as W41)

L54. Do you utilize UPSs for your LANs?

L55. How is data on your LANs backed up?

L57. What bridges does your site currently use?

L58. What gateways does your site currently use?

L59. What Network Management Tools do you currently use? (Same as W44)

L60. What off-site communications services do you currently use?

L61. What safe-guards do you have to prevent viruses from being transmitted via your LANs?

L62. What Procedures do you follow for configuring and maintaining your LANs? Please attach and label "Attachment L62".

L63. Who does the physical installation of your LANs?
(Please specify Name, Phone#, Fax#, Code, Mailing Address and EMail Address.)

L64. What type of LAN topology is used? (Same as W45)

L69. What is your total annual expense for LANs at your site?
(Include all cost as defined in Life Cycle Management.)
Please attach and label "Attachment L69". (Same as W46)

L70. What "fire-walls" do you currently have protecting your LANs? (Same as W47)

L71. Who is your LAN security officer? How is this individual contacted?
(Please specify Name, Phone#, Fax#, Code, Mailing Address, and Email Address.)

L72. Are mail logs kept showing where traffic is going to/coming from?
If so, how long are these logs kept? Is it manual or electronic?

L73. Provide a block diagram describing mail flow at your site.
(Label this document "Attachment L73".)

L74. Is remote access to your mail systems supported?
If so, by what methods?

L75. Does your environment support MAPI?

L76. Does your environment support VIM?

L77. Does your environment support XAPI?

L78. Does your environment support AOCE?

L79. Does your environment support ODBC?

L80. Does your environment support OLE 2.0?

L81. Does your environment support OpenDoc?

L82. Does your environment support any other object sharing technologies?

L83. What does your site consider a "LAN"?

L84. How geographically dispersed is LAN?

L85. Who performs O&M on LANs?

L86. Are bridges used for filtering?

L87. Does your site employ remote link bridging?

L88. Is bridging dynamic or static?

L89. Is inside cable plant owned by NAVAIR activity?

L90. Are networks accredited?

L91. Does your site have a network security plan / officer?

L92. What other network access controls are employed?

Site LAN Infrastructure Questions

LI1. Number of thick Ethernet Networks (10base5)?

LI2. Number of thin Ethernet Networks (10base2)?

LI3. Number of twisted pair Ethernet hubs (10 baseT)?

LI4. Number of Ethernet nodes (not counting bridges/routers etc.)?

LI5. Number of Ethernet routers?

LI6. Number of Ethernet bridges?

LI7. Number of Ethernet repeaters?

LI8. Are all of the Ethernet networks interconnected? If not, how many are stand-alone?

LI9. Number of broadband networks?

LI10. Single cable or dual cable?

LI11. Mid split, high split, or low split?

LI12. Number of directly connected broadband nodes?

LI13. Number of broadband/ethernet bridges/gateway?

LI14. Number of broadband/Appletalk bridges/gateway?

LI15. Is broadband used for backbone connectivity, local connectivity or both?

LI16. Number of Apple-Local talk bus networks?

LI17. Number of Localtalk active star networks?

LI18. Number of Localtalk passive star networks?

LI19. Number of Localtalk nodes?

LI20. Number of Localtalk repeaters?

LI21. Number of Localtalk/Ethernet bridges/gateways?

LI22. Number of FDDI networks?

LI23. Number of FDDI nodes?

LI24. Number of FDDI/Ethernet bridges/routers?

LI25. Number of FDDI/Broadband bridges/routers?

LI26. Is FDDI used for backbone connectivity, local connectivity, or both?

LI27. Are all of the FDDI networks interconnected? If not how many are stand-alone?

LI28. What other network technology and quantities are in use at your site (Arcnet, SNA, etc.)?

LI29. Are these networks interconnected or stand-alone?

LI30. Number of nodes supported by these other networks?

LI31. Are non-centralized modems available to dial into your LAN?

LI32. Are centralized modems available to dial into your LAN?

LI33. Is a modem security system in place ?

Site NOS Questions

N1. Are any of your workstations being used in a client/server environment?(Same as L6)

N2. Do you have a Unix Mail Server? If so, are you RFC 822 compliant?

N3. What NOS(s) are used on your LAN(s)? Include versions. (Same as L10.1)

N4. For each NOS list the servers and services provided.

(i.e. file servers, print servers, facsimile servers) (Same as L11)

N5. How many users do you have on each NOS?

N7. For each NOS, give details on the network protocols supported.

(i.e. SMB, NCP, FTP, FTAM, NFS, etc.)

N9. Do any of your LANs provide data encryption? (Same as W21/L13)

N10. Do any of your LANs handle classified data? (Same as W22/L14)

N11. Do you currently have a site wide bulletin board system?

What is the make and model of this system? (Same as L15)

N12. Do you have one site-wide mail system that is available to all your LAN users? (Same as L17)

N13. Do you support off-site access to your LANs?

If so, what type of access? How do you provide security for this access? (Same as L19)

N16. What software do you distribute via your LAN? (Same as L23/T2)

N17. Do you have automated fault notification? (Same as W27/L34)

N18. Do you have automated net intrusion monitoring? (Same as W28/L35)

N20. Do you provide a "help desk" for your LAN users? (Same as L37)

N21. What safe-guards do you have to prevent viruses from being

transmitted via your LANs?

N26. Do you support a site-wide directory?

If so, please attach and label "Attachment N26".

N27. If you have a site-wide directory, is it automatically synchronized between e-mail

systems? (X.400, X.500, NIC registry, other electronic) If so, how?

N32. How many post-offices, mail centers, or mail server does your site support? Break this

information down by mail system, if applicable.

N33. Provide a block diagram describing mail flow at your site?

Please attach and label "Attachment N33".

N35. Does your site run any mail enabled applications?

If so, list them.

N45. What mail gateways does your site use? Please describe.

N47. Are there currently plans to consolidate to a single e-mail system? (If so, provide a copy of these plans and mark them "Attachment N47").

N48. What is the mix (type and number) of client operating systems (DOS X.X, Macintosh System X.X, etc.) your NOS(es) supports?

N49. What session layer protocols does your NOS Support (NETBIOS, NCP, GOSIP, etc.)?

N50. Does your current NOS support DCE? Do you plan to support DCE?

N51. Provide a block diagram describing your external mail flow.
Label it "Attachment N51".

N52. Provide a detailed document describing your messaging infrastructure.
Label it "Attachment N52".

Site Tools & Applications Questions
T1. How does the site handle the licensing of proprietary products? Provide any policies or procedures dealing with licensing or product distribution and mark them "Attachment T1"

T2. What software do you distribute via your LAN? (Same as L23/N16)

T3. Does your site run any mail enabled applications?
If so, list them.

Site Configuration Management Questions

C1. Do you have a LAN/WAN Network Configuration Management System?

C2. Is it paper or automated?

C3. What type of platform does it run on? What type of software, operating system, and version number?

C4. What is the size and structure of the database?

C5. How often is it updated and give date of last update?

C6. How many users have access to the system?

C7. Give the Name, Phone#, Fax#, Code, Mailing address, and EMail address of the System Administrator.

C8. Does your site have any of the following system capabilities?
Trouble ticketing
Fault Management
Account Management
Performance Management
Asset Management?
(Please attach documentation, label it "Attachment C8")

C9. Is there view, report and real-time capability?

C10. What type of system security?

C11. Is there a librarian function?

C12. Are there scheduled audits?

Date of last audit?

(Please attach audit, label it "Attachment C12".)

C13. Do you have the following:

logical and physical network layout

drawing or diagramming tools

network addresses

cables

workstations

(Please attach any write-ups, label them "Attachment C13".)

C14. Are there procedures for implementing changes? (Please attach procedures, label it "Attachment C14".)

C15. Do you have LCM documentation? (Charter, GFR, POA&M, Plan, Other.) Please attach and label "Attachment C15".

C16. Are there other documentation regarding design, plans usage of the network, etc.? (Please attach, label them "Attachment C16".)

C17. Are there plans for a new or upgrade of CM system? (Please attach plans, label it "Attachment C17".)

C18. Do you have a help desk available to you for hardware and software problems and questions? Do you require standardized forms (i.e. style sheets, formatted spreadsheets, standard slides) to accomplish your job?

C19. Do you have a standard operating procedure (SOP) for preventing virus infections?

C20. Who provides LAN Administration?
(Please specify Name, Phone#, Fax#, Code, Mailing address, EMail Address.)
(Same as L32)

C21. Do you have a Network Control Center?
If so, what services are provided? (Same as L33)

C22. What is your total annual expense for LANs at your site?
(Include all cost as defined in Life Cycle Management.)

C23. Are there currently plans to consolidate to a single e-mail system? (If so, provide a copy of these plans and mark them "Attachment C23").

C24. Does activity employ site-by-site or enterprise NMCC?

C25. Is control centralized of distributed?

C26. Does site have NMCC policies / procedures? Are they documented?

Site Routers Questions

(These questions are in a separate database and are asked for each router.)

R1. What is the model of this router?

R2. What is the revision level of this router?

R3. List all router interfaces by type and use(en0 is local ethernet connection, serial0 is RS-422 56 Kb link to PAX).

R4. List the unused interfaces.

R5. How is this router managed (remote, central)?

R6. Is this router used for bridging?

Site Mail System Questions

(These questions are in a separate database and are asked for each mail system.)

M1. Describe this mail system.

M2. How many users does this mail system support?

M3. Are mail logs kept showing where traffic is going to/coming from?
If so, how long are these logs kept? Is it manual or electronic?

M4. Is this mail system accessible 24 hours a day 7 days a week?

M5. How many mail messages per week; stay locally within the mail system
it is originated on; stay within your site; and leave your site?

M6. Describe how this mail system handles rejected mail.

M7. Does this mail system work with attachments, text and binary, including Macintosh file
with separate forks?

M8. Is remote access to this mail system supported?
If so, by what methods?

M9. Does this mail system support groups or distribution lists?

M10. If this mail system has a directory, what is the extent of its population?
(system-wide, site-wide, NAWC-wide, other) In other words, if this system
has a directory, what information is currently in it?

M11. Does this mail system support encrypted or secure data?

Site Desktop Computers Questions

(These questions are in a separate database and are asked for each type of computer.)

CS1. How many desktop systems of this type does your site have?

CS2. What operating systems are these machines running?

(Please include version # and percentage of machines running it.)

CS3. What size hard disks are used in these systems?

CS4. What video resolutions do these systems have?

CS5. How much memory is installed in these systems?

Site Application Software Questions

(These questions are in a separate database and are asked for each type of system.)

AS1. What EMail Software packages are used on these systems?

AS2. What Word Processing software packages are used on these systems?

AS3. What Spreadsheet software packages are used on these systems?

AS4. What Communication software packages are used on these systems?

AS5. What Database software packages are used on these systems?

AS6. What Planning/Project tracking software packages are used on these systems?

AS7. What Utility software packages are used on these systems?

AS8. What File Compression software is being used on these systems?

AS9. What Disk Compression software is being used on these systems?

AS10. What Virus Protection software is being used on these systems?

AS11. List any other important software being used on these systems?

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